The Botanists Diels and Pritzel in Western Australia: A Centenary

J S Beard

6 Fraser Road, Applecross WA 6153
e-mail :jsbeard@global.net.au

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Ludwig Diels and his companion Ernst Pritzel arrived in Western Australia on Oct 30 1900 on a botanical expedition that was to last 14 months. During that time they travelled as widely as possible in the limited state of development of the Colony, collecting specimens (Pritzel 1016 specimens, Diels 4700) and making observations of the vegetation. On leaving in Dec 1901 they proceeded to the Eastern States and New Zealand. After returning to Germany they at first collaborated on writing up their botanical collections, published in Engler's *Botanische Jahrbücher* in 1904 and 1905 (Diels & Pritzel 1904-05) which included the description of 235 new species. In 1906 Diels published his observations in a book *Die Planzenwelt von West-Australien südlich des Wendekreises* (The Plant World of Western Australia south of the Tropic). This was of 416 pages and a landmark, publishing new information on the flora, descriptions of the vegetation, and a small coloured vegetation map of Australia.

The book was only published in German, which few people in Western Australia could read at that time, and was not translated for publication in English. After the establishment of the University of Western Australia, the Botany Department undertook to translate Diels' book but only typed copies were made. D J Carr (1981) published a translation of an introductory chapter, pp 41-72 of the book, which gives details of previous botanists who had worked in Western Australia.

Few details of Diels' travels and his career are available in the book, but an obituary by H Ziegenspeck (1952) was published in German in the South American journal *Revista Sudamericana de Botanica.* A translation of this is given as an appendix to this paper. The account of the expedition which Diels gave in an address in Berlin on his return (Diels 1902) does not contain any information additional to the later book.

Ludwig Diels

Friedrich Emil Ludwig Diels (Fig 1) was born in Hamburg, Germany, in 1874 to a family of distinguished academics. He took early to botany and studied taxonomy under Engler, and geography under von Richthofen, at Berlin. His doctoral thesis was titled "Vegetation Biology of New Zealand". He had not at that time visited that country but after graduating began to prepare plans for a tour of the southern hemisphere, visiting South Africa, western and eastern Australia, and New Zealand, with principal emphasis on Western Australia. In January 1900, at the age of 25, he proposed this journey to the Humboldt Foundation for Nature Research and Travel, and obtained approval and funding. With a travelling companion Ernst Pritzel (see below) he left Germany in the same year via South Africa where between August and mid-October 1900 they visited the Western Cape and adjoining area of the Karoo near Calvinia. On Oct 30 1900 they disembarked at Fremantle, and started work in mid-November.

Figure 1. Friedrich Ludwig Emil Diels, 1874-1945. Photograph supplied by Botanic Garden & Museum, Berlin-Dahlem.

Diels and Pritzel left Fremantle at the end of December 1901 for eastern Australia and New Zealand, but we have found no record of where they went and how long they stayed there. They were back in Berlin by October 1902. Diels had already been appointed to the staff of Berlin

University in 1900, and he worked there on the results of his expedition. In 1906 he accepted an appointment as Professor at the University of Marburg, a position which he enjoyed, developing also a happy home life with a wife and four children. Later the family moved to Berlin when Diels was appointed Assistant Director of the Botanical Museum in Berlin-Dahlem as successor to Urban, and working under Engler. In 1929 he became Director-General of the Museum, and in 1933 a member of the Academy, thus reaching the peak of his career. In 1933 he undertook a journey to Ecuador, repeating his experiences in Western Australia and in the same way writing a book and papers to follow. Shortly after this he renewed his connection with Western Australia through Charles Gardner who had been appointed Government Botanist in the State in 1929, and acted as Australian Botanical Liaison Officer at the Royal Botanic Gardens at Kew from March 1937 to January 1939. During this period Gardner visited Berlin where Diels allowed him to examine his collections and to remove small pieces of specimens which are now in the Western Australian Herbarium. It is likely that Diels inspired Gardner to extend his earlier treatment of the vegetation of the State to include the tropical north and desert interior. Gardner did this in a lengthy paper to the Royal Society of Western Australia in 1941 which owing to the war was not published until 1944 (Gardner 1944) and the appropriate map even later (Gardner & Bennetts 1956). Gardner added a Northern Province and numerous new Botanical Districts to Diels' previous work.

The outbreak of war in 1939 brought disaster with the destruction of the herbarium and library at Berlin-Dahlem by allied bombing. Diels was very disheartened by this. He died at the end of the war in 1945 at the age of 71. Fortunately his and Pritzel's collections were not all lost, as specimens are recorded as held today in 30 of the world's herbaria (Orchard 1999). The Western Australian Herbarium holds 239 specimens collected by Diels in the State, 398 by Pritzel and 540 under their joint names, a total of 1177. These include those few obtained by Gardner in 1939 (N Marchant, WA Herbarium, personal communication).

Ernst Pritzel

Of the life and career of Ernst Pritzel, who was less eminent, we have fewer details. No obituary or biography has been located. He was born in Germany on 15 May 1875 and died, probably in Berlin, on 6 April 1946, so that his life span was similar to Diels'. He was a noted phytogeographer and taxonomist, his best-known contributions being Lycopodiaceae and Psilotaceae in Engler & Prantl's *Die Natürlichen Pflanzenfamilien* in 1901 and Pittosporaceae in 1930. According to Hall (1978) he collected at Coolgardie in 1907, implying a second visit to Western Australia, but this is thought to be a mistake for 1901. Pritzel's specimens in the W A Herbarium are all dated 1900-01. The genus *Pritzeliella* P C Hennings was named after him in 1903, and he was specially honoured by his colleagues at a celebration of his 60th birthday in 1935. No portrait-photograph of him is known to be available, but it is possible that he is shown as the scale-object in the photograph Plate XXXIV of the book of Diels (1906).

Vegetation Studies

In approaching their work in Western Australia, Diels made it clear from the start that he intended a wider scope than just botanical collection. His prime interest would be in the vegetation, stated in the very first sentence of the foreword to the 1906 book:

"In our knowledge of the plant world of Western Australia there has for a long time been a strange incongruity. The floristic elements were well known: on the other hand one knew nothing as to how they fitted into the picture as vegetation".

Diels and Pritzel therefore travelled as widely as possible, collecting as they went, but Diels must have made exhaustive notes on the vegetation, and Pritzel took photographs. There is a map on p 68 of Diels (1906) that indicates the areas botanically explored up to that time and shows their journeys by dotted lines (reproduced as Fig 1.4 by Beard 1990). A slightly better map accompanied their joint paper of 1904-05 and is reproduced here as Fig 2. No details are available as to

Table 1

Time-table of the travels of Diels and Pritzel in Western Australia, including collecting localities.

1900	30 October	Arrived Fremantle.
	November	Toodyay-Northam-York, Coolgardie.
	December	Serpentine River, Geographe Bay.
1901	January	Champion Bay, Watheroo, Toodyay-Northam-York, Collie River, King George Sound.
	February	Mogumber-Moora-New Norcia, Toodyay-Northam-York, Bridgetown, Bunbury.
	March	Bunbury, Bridgetown,Busselton, Cape Leeuwin, Lake Muir, Albany. Depart for the Pilbara by sea.
	April	Nickol Bay, Roebourne.
	May	Serpentine River, Tammin, Southern Cross, Toodyay-Northam-York, eastern hills of Darling Range, Stirling Range.
	June	Serpentine River, Mogumber-Moora-New Norcia, Watheroo, Mingenew, Irwin River, Champion Bay.
	July	Cue, Champion Bay, Greenough River, Watheroo, Tammin, Stirling Range, Cape Riche.
	August	Carnarvon, Champion Bay, Watheroo, Greenbushes, Toodyay-Northam-York, Mogumber-Moora-New Norcia.
	September	Champion Bay, Greenough River, Irwin River, Mingenew, Watheroo, Toodyay-Northam-York, Stirling Range, Swan River.
	October	Pallinup River and east to the Phillips River, Stirling Range (ascending Toolbrunup and Mt Trio, Collie River, Tammin, Bullabulling, Menzies.
	November	Coolgardie, Esperance, Karalee, Southern Cross, Watheroo, Champion Bay, towards the Murchison River.
	December	Mogumber-Moora-New Norcia, Bunbury, eastern hills of Darling Range. End of December left Western Australia.

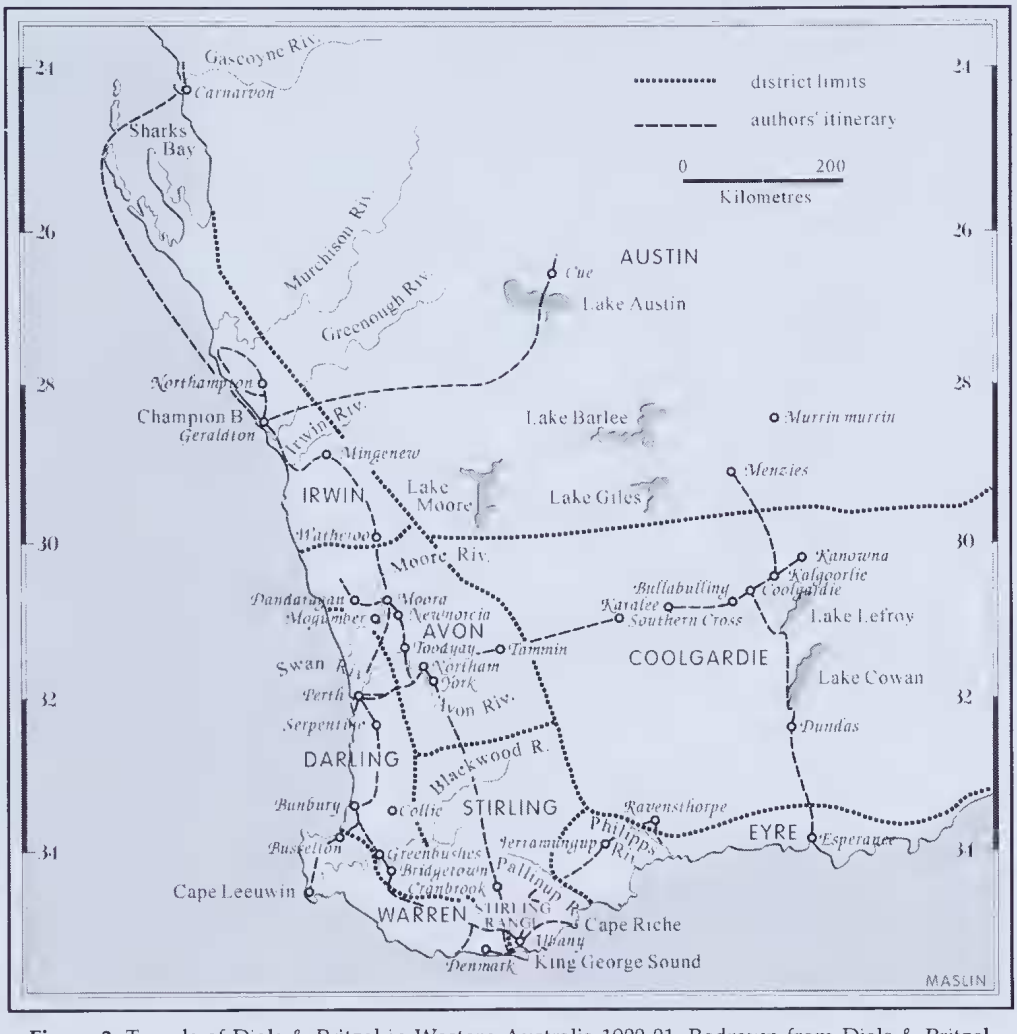

Figure 2. Travels of Diels & Pritzel in Western Australia 1900-01. Redrawn from Diels & Pritzel 1904-05 by John Maslin.

how they travelled, where they stayed en route, camping or otherwise, nor how they dried their specimens. Handling such a large quantity, an average of 100 specimens a week when they were constantly on the move, must have been a major problem. A table is appended showing where they went, compiled from the 1905 paper with some amendments using data from the 1906 book. In addition to these sorties they mentioned collecting around the Swan River in all months and around King Sound in almost all months. It is clear that they must have travelled principally by train as most of the travel shown on the map coincides with the railways which already existed, enabling them to reach the Goldfields *e.g.* Kalgoorlie, Menzies and Cue. However in March 1901 they travelled by road from the Blackwood River via Lake Muir to the south coast. They also travelled by road from Albany through the Stirling Range and as far east as the Phillips River, and from the eastern goldfields to Esperance. In March-April 1901 they made a sortie by sea up to the Pilbara at Roebourne, and to Carnarvon in August.

The results of their taxonomic work were published jointly in 1904-05 (Diels & Pritzel 1904-05) at Berlin in Engler's *Botaniche Jahrbücher*, in a volume of over 600 pages. This lists and describes all of their collections, including a great deal of ecological data, and illustrates many species. A catalogue of Pritzel's specimens is included, apparently in the order collected from 1 onward. Diels' collecting numbers in W A were 1500-6160.

Diels' book of 1906 consisted of 413 pages, written essentially from an ecological viewpoint. It is divided into an introduction and five chapters. The Introduction is headed "The Main Features of the Plant World of Australia" with general descriptions of the vegetation classified under 9 formations, and a section on floristics. This is accompanied by a small coloured vegetation map of Australia, the whole of Australia not just the west, scale 1:27 000 000, at the back of the book, using the same plant formations as in the chapter except for Riverain Woodlands left out owing to scale. A table on p 26 of the book gives a detailed key to the formations mapped, but there is no other mention of the map in the text, so that we do not know how or when Diels compiled it nor what sources of information were available to him. The map is of particular interest in that it appears to have been the first vegetation map of Australia to be published. A facsimile reproduction of this map has been published elsewhere (Beard 2001; Fox *et al.* 2001).

Chapter 1 of the book is headed "History and Literature of the Botanical Exploration of Extra-tropical Australia" and is the portion translated by D J Carr

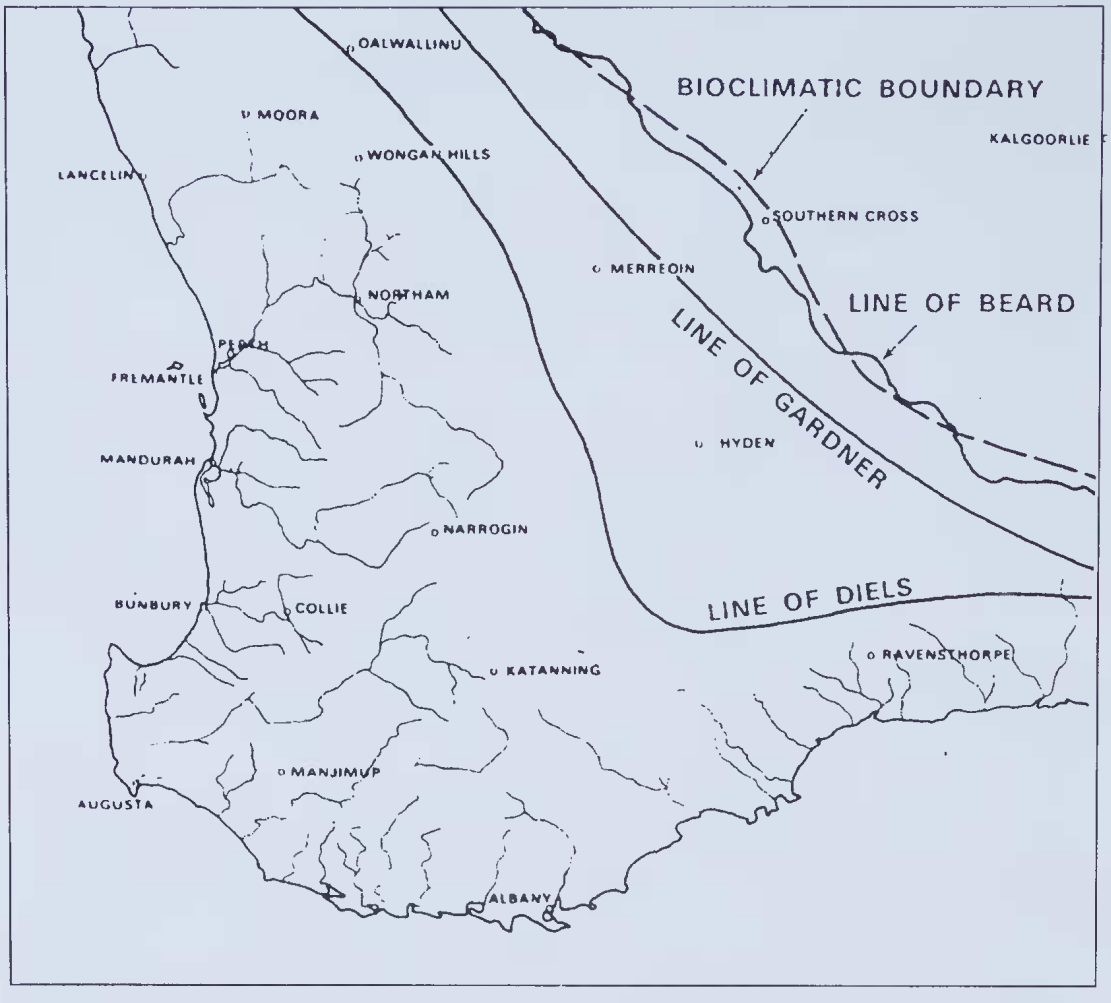

Figure 3. Comparison of the positions of the boundary of the South-West Botanical Province according to Diels (1906), Gardner & Bennetts (1956) and Beard (1980), with the bioclimatic boundary (Beard 1980).

(1981). It is followed by another short general chapter, "Summary of the Physical Geography of Extra-tropical Australia". Chapters 3 and 4 are devoted to detailed descriptions of the vegetation of the South-West and Eremaean Provinces, both floristic and ecological, using a physiognomic classification of plant formations. Curiously, these bear no relation to the classification used for the vegetation map, and with other discrepancies give the impression that the introductory chapters including the map were written separately and at a different time from the chapters dealing specifically with Western Australia. The final chapter of the book establishes Diels' famous biogeographical classification of the southern part of Western Australia into two Botanical Provinces, subdivided into Botanical Districts. The South-West Province was divided into six Districts and the Eremaean Province (as far as known to him) into two. Gardner (1944) expanded this to cover the whole State with the addition of a Northern Province and numerous new Districts, and the system has been later refined by Beard (1980), Beard & Sprenger (1984) and Thackway & Cresswell (1995). This recognition of ecological regions has been one of Diels' most enduring legacies. The boundary between the two Provinces, he said, coincided approximately with the 300 mm rainfall line, separated the internal drainage area of the country from the portion draining to the sea, was of importance to human settlement in being the boundary of cereal cultivation and had also at that time been picked up in zoogeography (Woodward 1900). Modern rainfall maps show the 300 mm isohyet further east. Diels information was influenced by a relatively dry cycle during the years before his visit. His observation on the drainage pattern is true up to a point as his line coincides with that chosen by Jutson (1914, 1934) as the boundary between his Swanland and Salinaland Physiographic Divisions, and is also the Meckering Line of Mulcahy (1967). More recent work has revised our views of the drainage systems (Beard 1999, 2000). Cereal cultivation has moved out much further east since Diels' time. Woodward's zoogeographic map of 1900 can no longer be traced for comment. C A Gardner (in Gardner & Bennetts, 1956) redrew the State's Botanical Provinces and Districts and moved the boundary of the South-West Province somewhat further east. Beard (1980) moved it a little further still, basing his line on vegetation mapping. These contrasting treatments are shown in Fig 3.

Any work of this kind is likely to be subject to later revision, which does not obviate recognition of the pioneer basis. The expedition of Diels and Pritzel was unique. They came equipped for quite a long stay with the intention of making as far as possible a comprehensive survey

of the southern half of the Colony. It was entirely on Diels' own initiative, he had not been invited or commissioned by the Colonial Government to do this, and he had obtained his own funding from the Humboldt Foundation in Germany. On return home he made his own arrangements to publish a very comprehensive book of over 400 pages, including a vegetation map of the whole of Australia (not just the west) which appears to have been the first of its kind. It was certainly a unique achievement.

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Appendix

Obituary of Ludwig Diels (1874-1945) by H Ziegenspeck (1952)

Translated by Pamela Beard

Ludwig Diels was born on Sept 24 1874 in Hamburg, the eldest son of the modern language philologist Hermann Diels. Seldom has a family experienced such a stimulating influence as that exerted on the sons, as happened to the botanist Ludwig Diels and his brothers, the Slav expert Paul and the chemist and Nobel prizewinner Otto.

Their father as well as their mother came from Nassau, and he had as a young grammar school teacher answered the prize questionnaire of the Berlin Science Academy so brilliantly that he was called to Berlin where he spent 33 years on the Academy staff, soon became a University Professor and was finally appointed permanent secretary to the Academy. It was here that the young Ludwig grew up, completing his studies as head boy at the grammar school where he showed a special talent for botany.

He conscientiously studied systematics with Engler and geography with von Richthofen. His dissertation "The Vegetation-biology of New Zealand" showed the direction of his life's work. While the morphological and anatomical aspects may be a principal response to environmental factors, the floristic history in the absence of competition on an island may be the explanation of contradictions. The enormous diversity from the coastal flora to the moist forest areas excited the delight in diversity of the systematists as well as of the vegetation biologists. There followed papers such as the treatment of the ferns in "Natural Plant Families", the "Flora of Central China, Juvenile Forms and Mature Flora in the Plant Kingdom" and above all "The Plant World of Western Australia", the outcome of a long journey taken with Pritzel.In South America reference should be made to his study of the Annonaceae, Myrtaceae, Oxalidaceae and Proteaceae, as also the Weberbauer collections and finally the study of the Droseraceae, Menispermaceae and Iridaceae in Engler's Plant Kingdom.

Recognised as a University Lecturer in Berlin in 1900, Diels became busy at the Berlin University. In 1906 he accepted an appointment in Marburg where he worked in plant geography and systematics. The "Marburg years" were the joy of his life. Here he was happily married, here his four children were born, one son and three daughters. Here he was able to live his scientific and teaching career to the full, free from administrative and academic duties.

This happy time came to an end because of an offer of an appointment as Asst Director of the Botanical Museum in Berlin-Dahlem, as successor to Urban. To work with such a demanding boss as Engler was not easy. Diels managed to continue his goals, which were never of a self-seeking kind, by slipping them into his other work. Those who did not know him very well took him to be a reserved, highly qualified person which was not at all his true self. He was far more sensitive than he appeared, though he knew how to hide his innermost feelings. Diels worked until 1921 under Engler; in 1929 he was promoted to Director-General, and in 1931 he was appointed a member of the Academy. In this way he reached the summit of his career, but remained the same selfless person. Imperceptibly he altered the way the institution was run, during which Pilger, the Asst Director, stood loyally at his side. His colleagues were given much freedom. He operated according to his own standard and his totally scholarly approach.

In 1933 he undertook a long desired journey to Ecuador, about which he reported in his book "Contributions to the understanding of the vegetation and flora of Ecuador", and also in the monographs "New species from Ecuador I-V". After his return to Europe an unfortunate time began for Diels, which was only relieved by the marriage of his daughters and the birth of a grandchild. His much loved son was the victim of an air disaster. The destruction of the herbarium and of the library, which went up in flames during the night of March 1-2 [year not stated] during an air raid, was a blow from which he never recovered. Outwardly he remained composed. Because of the coal shortage the stock in the greenhouses was frozen, and during the final stages of the fighting around Berlin the outdoor parks were destroyed. After the war the black market appeared but he would have nothing to do with it. He struggled tenaciously against the gradual decline of his strength, and continued to fulfil his duties until shortly before his death. On Dec 30 1945 he died peacefully in his official residence. He is buried in the Botanic Garden alongside Schweinfurth and Engler.

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